civil defense Technical Bulletin

Appendix 3

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A DIGEST OF TECHNICAL INFORMATION

EMERGENCY MEASUREMENTS OF RADIOACTIVITY IN FOOD AND WATER

Immediately after a nuclear attack, communities must be in a position to determine quickly if available food and water are sufficiently free of radioactive contamination to permit their consumption. The rapid evaluation of this hazard is essential not only to prevent ingestion of dangerous amounts of radioactive material, but also to avoid the equally serious mistake of denying a stricken community access to drinking water and food which could be used with safety.

This bulletin presents a method of measuring radioactivity in food and drinking water, and describes a method of preparing a radioactive comparison standard designed to provide a check against the following 10- and 30-day acceptable beta-gamma concentrations.

Acceptable Beta-Gamma Activity

Estimated consumption period	μc/cc	dps/cc
10 days	9×10^{-2}	3×10^{3}
30 days	3×10^{-2}	1×10^{3}

Method of Measurement

Almost any convential beta-gamma geiger counter with a scale of 0-20 mr/hr, or OCDM CD V-700, "Radiological Survey Meter, Geiger Counter, Probe Type, Beta-Gamma, Discriminating," may be used with a comparison standard in making the measurements. Although it is preferable to have two standards, one comparable to the 30-day activity and one comparable to the 10-day activity, adequate measurements may be made with only one. If the standard is comparable to the 10-day acceptable limit, the geiger counter reading is divided by three when making the 30-day checks; and conversely, if the standard is for the 30-day check, the reading is multiplied by three for the 10-day measurement. The following procedure should be followed:

(*a*) Turn on the geiger counter, open the beta shield, and observe the reading. If the background gives an appreciable indication on the least sensitive scale (0–20 or 0–50 mr/hr), the area or the instrument is too contaminated, and measurement should be made in another area or with another instrument. If there is no appreciable indication on this scale, the instrument and location are satisfactory.

(*b*) Place the standard face up on a level surface. Turn the geiger counter selector switch to the least sensitive scale and place the probe, with the beta shield open, across the standard with the exposed part of the geiger tube facing the standard. The probe should rest on the edge of the standard container, or a jig should be used so that the exact position of the probe may be reproduced. The instrument reading should be noted.

(*c*) Fill or pack the suspected food or water to a depth of at least 2 mm. in a container the same size as the standard. A greater depth may be used, if necessary, to permit positioning the probe the same distance from the sample's surface as it was from the standard's surface. (If standard 4-oz. ointment tins are used, the container should be filled to the indentation circling the tin.) Place the probe, again with the beta shield open, in exactly the same position with respect to the surface of the sample as it was with respect to the standard. If the reading is less than that of the standard, the food or water may be used for the period indicated.

Other types of instruments that have sufficient sensitivity, such as ionization chamber instruments and scintillization counters, may be used. However, a comparison standard suitable for use with a geiger counter is not necessarily suitable for use with other types of equipment.

Preparation of Comparison Standards

The following applies to preparation of a standard comparable to the 10-day acceptable value and suitable for use in the procedure described above. Each standard should contain 3.0 gm. of finely powdered (60 mesh) uranyl acetate [$UO_2(C_2H_3O_2)_2\ 2H_2C$] embedded in 5.0 gm. of liquid casting plastic. The standards may be prepared in batches of five by weighing out six times the quantity of each ingredient into a 100 ml. beaker. (The 20 percent excess allows for

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material adhering to the beaker.) After thoroughly mixing with a narrow glass rod, 6 to 8 drops of hardening catalyst should be added, and the mixture stirred for 5 minutes. Standard 4-oz. ointment tins (7.9 x 2.3 cm.) should be used and the inner surfaces should be swabbed with carbon tetrachloride (CCl_4) to remove any adhering film of grease. Eight gm. of the mixture should be weighed into each lid, which should then be rotated by hand to provide a uniform layer. Lids should be heated on a hot plate at a low heat until the plastic begins to harden. The lids should then be removed from the hot plate because overheating will cause the plastic to separate from the lid.

Other uranium compounds might be employed, including oxides as well as salts, in an amount proportional to the desired uranium content. Any plastic embedding material might be used, but the so-called cold setting type is preferred over those that require high temperature polymerization. Both the plastic and catalyst may be obtained in small quantities from hobby shops.

References

"Survey Meters for Water Monitoring," Hursh, J. B., Zizzo, S., and Dahl, A. H. Nucleonics, vol. 9, No. 5, November 1951.

"Permissible Emergency Levels of Radioactivity in Water and Food," TB-11-8, OCDM.

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